Chapter G6: Habitat Based Analysis

INTRODUCTION

Aquatic species without primary or direct uses account for the majority of losses at cooling water intake structures (CWIS). These species are not, however, without value to society. It is important to consider the non-use benefits to the human population produced by the increased number of these fish under the final section 316(b) rulemaking.

One way to put impingement and entrainment (I&E) losses into perspective is to value the habitat necessary to replace the lost organisms. The value of fish habitat can then provide an indirect basis for valuing the fish that are supported by the habitat.

EPA explored this approach for the Great Lakes region. However, EPA did not include the results of this approach in the benefit analysis because of certain limitations and uncertainties regarding the application of this methodology to the national level. These limitations and uncertainties are discussed in Chapter A15. Thus, this chapter outlines the approach explored by EPA, but does not present benefit estimates.

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The approach discussed here uses values that survey respondents indicated for preservation/restoration of wetlands to evaluate losses of fishery resources in the Great Lakes region. This analysis is not intended to value directly benefits provided by the lost fish and shellfish, but to provide another perspective on the I&E losses by looking at values of habitat necessary to replace them. The method first estimates the quantity of wetland habitat required to replace fish and shellfish lost to I&E, and then assesses respondents' values for these habitats. These data are then combined to yield an estimate of household values for improvements in fish and shellfish habitat, which provides an indirect estimate of the benefits of reducing or eliminating I&E.

This benefit transfer approach involves three general steps, described in detail in Chapter A15:

1. Estimate the amount of restored wetlands needed to produce organisms at a level necessary to offset I&E losses for the subset of species for which potential production information is available.
2. Develop willingness-to-pay (WTP) values for fish production services of wetlands ecosystems.
3. Estimate the total value of baseline I&E losses by multiplying the WTP values for fish and shellfish services of restored wetlands by the number of acres needed to offset I&E losses.
4. Estimate the total benefits of the final section 316(b) rule, in terms of the value of decreased I&E losses, by multiplying the WTP values for fish and shellfish services of restored habitat by the number of acres of each habitat type needed to offset decreased I&E losses.

The rest of this chapter outlines EPA's exploratory application of this method to the Great Lakes region.

G6-1 Data Summary

EPA used available fish sampling data for Great Lakes wetland habitat (Brazner, 1997; personal communication, J. Brazner, U.S. EPA, 2001) to determine the number of acres required to offset I&E losses. To estimate public WTP, EPA used information from two studies of public values for wetlands: a study of the Maumee River Basin, located in the northwestern corner of Ohio near Lake Erie (de Zoysia, 1995); and a stated preference study from Narragansett Bay, Rhode Island (Johnston et al., 2002). These studies are described in detail in Chapter A15.

EPA based the benefit transfer of total value for fish habitat provided by wetlands on the Maumee River Basin study. Conducted in 1994, the study describes wetlands as providing a number of functions, including waterfowl and other bird habitat, fish nursery habitat, endangered species habitat, and water purification services. Thus, EPA assigned only part of the estimated WTP for wetlands restoration to fish habitat services, based on results from the Johnston et al. (2002) study.

G6-2 Benefit Transfer for the Great Lakes Region

G6-2.1 Estimating the Amount of Wetlands Needed to Offset Losses for Specific Species

The first step in the analysis involves calculating the estimated area of wetland habitat needed to offset I&E losses for the subset of species for which this habitat is limiting and for which production information is available. Details of this analysis are presented in Appendix G2. Based on a commonly used restoration scaling rule, the estimates of the acres of wetlands restoration needed to offset losses of these I&E species is based on the acreage needed for the species requiring the maximum quantity of habitat.

For any given species, the number of acres of restored habitat needed to offset I&E losses is determined by dividing the species average annual age one equivalent I&E loss by its estimated abundance per acre in that habitat.

G6-2.2 Estimating the Proportion of Wetland Value Attributable to Fish Habitat

Because fresh water wetlands provide a number of services such as bird habitat, water purification, and fish nursery habitat, EPA attempted to separate values for fish habitat from values for other wetland services. Given survey data available from the Maumee River Basin study, however, there is no direct means to estimate the proportion of total wetland value associated with fish habitat services alone. EPA therefore used the stated preference study from Narragansett Bay, Rhode Island, to adjust wetland values to reflect fish habitat services (Johnston et al., 2002). As discussed in Chapter A15, section A15-2.4, EPA used the results of the study to estimate the proportion of total WP value for wetlands that can be attributed to fish production services. Based on the Agency's calculations, 25.64 percent of total wetland restoration value is attributable to gains in fish habitat services, given representative, mean values for other wetland services.

Despite the fact that the Maumee River Basin study evaluated the importance of fresh water wetlands, and the Narragansett Bay study was conducted for coastal wetlands, EPA believes that the Narragansett Bay study is still applicable, for three main reasons:

1. According to the Maumee River Basin study survey, the services provided by fresh water wetlands include waterfowl and other bird habitat, fish nursery habitat, other endangered species habitat, and water purification services. The services listed in Johnston et al. (2002) for coastal wetlands include bird habitat services, fish habitat services, shellfish habitat services, and mosquito control. Because of the similarities between these services, EPA believes that the proportion from the Johnston et al. (2002) study that was calculated for use with the Peconic Estuary study can be applied to the results from the Maumee River Basin study.

2. This result is similar to the result from a study of fresh water wetlands by Schultze et al. (1995), which estimated that between 32.98 percent and 33.44 percent of WTP for resource cleanup in the Clark Fork River Basin was associated with "aquatic resources and riparian habitat."

3. Based on the results of EPA's analysis, the proportions of total value attributable to the four dominant wetland services in Narragansett Bay (bird habitat services, fish habitat services, shellfish habitat services, and mosquito control) are very similar. Each service provides roughly 25 percent of the total marginal utility associated with the combination of habitat improvements and mosquito control. This correspondence suggests that restoration providing similar scale improvements for each of these services should produce a roughly equivalent increment to utility. For wetlands that do not provide substantial access provisions (e.g., boardwalks) and that are of moderate or small size, it would be highly improbable for the proportion of value associated with fish habitat to fall significantly below the 25.64 percent approximation estimated here.

G6-2.3 Values per Acre of Wetlands for the Maumee River Basin

EPA first multiplied the value per household by the 25.64 percent, the proportion of wetlands value attributed to fish habitat, to get the value per acre per household for fish habitat services of wetlands. This value is $.0064 per acre per household. The Agency then multiplied this value per acre by the total number of households in the Maumee River Basin study area (235,721), yielding the value per acre of wetlands for the population surrounding the Maumee River Basin. The Maumee study defined the affected population as the total number of households in the 15 counties located in the Maumee River Basin. For this region, the total annual value per acre for fish habitat services of wetlands is $1,507.12. Table G6-1 shows these values.

Table G6-1: Estimated WP Values for Fish Habitat Services Provided by Wetlands from the Maumee River Basin Study (2002$)

	$/HH/Acre/Year[a]	Total WP/Acre/Year[b]
Total Value	$0.0064	$1,507.12

[a] Values shown are WP per household per *additional* (i.e, marginal) acre per year.
[b] Total WP per acre is calculated as household WP per acre times 235,721 total households in the study area.

G6-2.4 Applicability of Study Area to Policy Area

The values from the Maumee River Basin study were not adjusted to reflect the socioeconomic and demographic characteristics of the Great Lakes region. This creates uncertainty in the analysis. However, a comparison of selected demographic characteristics of residents of the Maumee River area to residents in the area around one facility — the JR Whiting facility — shows that their residents have similar levels of education and income. Respondents to the Maumee River Basin survey had a similar level of household income, and slightly more years of education. EPA believes that adjustment for socioeconomic differences is not necessary, given the minor differences in education and income between the two areas. Table G6-2 presents median household income and highest level of educational attainment for respondents to the Maumee River Basin survey, for residents of the Maumee River Basin study area, for residents in counties abutting Lake Erie, and for residents in abutting counties or within 32.4 miles of JR. Whiting.

Table G6-2: Comparison of the Income and Educational Attainment of the Maumee River Basin Study Area and the JR. Whiting Case Study Area

Population	Median Household Income (2002$)[a]	Percent of Residents, 25 Years of Age or Older, by Highest Level of Educational Attainment			
		Some or No High School	High School	Some College	College
Respondents to the Maumee River Basin survey	$46,922	14%	55%		31%
Residents in 13 counties in Maumee River Basin study area	$44,077	16%	39%	20%	25%
Residents in counties abutting Lake Erie near JR. Whiting	$46,880	17%	34%	23%	27%
Residents in abutting counties plus residents within 32.4 miles of JR. Whiting	$46,615	20%	31%	23%	27%

[a] For respondents to the Maumee River Basin survey, this table presents mean household income instead of median household income.

Sources: U.S. Census Bureau, 2000; de Zoysia, 1995.

G6-2.5 Determining the Affected Population

Evaluating the total value per acre of wetlands for the coastal population of the Lake Erie area requires a definition of the geographical extent of the affected population. The Maumee River Basin study defined the affected population as the total number of households in counties within the Maumee River Basin. Similarly, as described in Chapter A15, EPA defined the affected population for the Great Lakes region as households residing in the counties that:

1. Abut the affected water bodies; and
2. Are located within 10 miles of the facility.

These households are likely to value gains of fish in the affected water body, due to their close proximity to the affected resource.

As discussed further in Chapter A15, households in counties that do not directly abut the affected water bodies will also likely value the water body's resources.

G6-2.6 Habitat Values per Acre for the Affected Population

The total value per acre for the affected population is calculated by multiplying the value per acre per household by the total number of affected households.

G6-2.7 Estimating the Value of Habitat Needed to Offset I&E Losses for the Region

Due to limitations and uncertainties that make this valuation approach difficult to implement on a regional scale, EPA does not present aggregate values for I&E losses. These values would be calculated by multiplying the total number of acres of each habitat required to offset losses by the value per acre for the affected population.

G6-3 Limitations and Uncertainty

A number of issues are common to all benefit transfers. Benefit transfer involves adapting research conducted for another purpose in the available literature to address the policy questions at hand. Because benefits analysis of environmental regulations rarely affords enough time to develop original stated preference surveys that are specific to the policy effects, benefit transfer is often the only option to inform a policy decision. Specific issues associated with this approach are discussed in Chapter A15.